Memorandum

Project Name: Hamlet of Pangnirtung	Project #: FRE-00232735-A0 /File No:
To: Bhabesh Roy, P.Eng.	From: Stephen Bliss, P.Eng.
Date: 2017 Dec 15	
Subject: Pangnirtung Water Reservoir – Berm Repairs	
Prepared By: Stephen Bliss, P.Eng.	
Distribution: Bhabesh Roy, GN; Ron Ladd, SAO - Pangnirtung	

The following Technical Memo will serve to describe the problem of berm erosion and subsequent repairs to the berm.

Timelines

The issue of berm erosion was first brought to light during the Water Licence Site Inspection (July 27, 2016 – refer to attached). As reported in that inspection, it was noted that "3. The berm wall around the reservoir has a depression near the northeast corner. This was likely caused from upstream surface water run-off. The depression is likely allowing surface water from the surrounding environment to flow into the reservoir during heavy rainfall events only. This should be addressed to maintain the designed integrity of the structure."

At that time, Kudlik Construction was in the process of completing the construction of a new Truck-Fill Station. They were tasked with making repairs to the berm plus improve upon the diversion ditching so to prevent any future potential erosion events. A subsequent construction site review report (Arktis Solutions, September 7, 2016 – refer to attached) discussed the repairs that were completed.

The 2017 Water Licence Site Inspection (October 2, 2017 – refer to attached) makes note that the erosion (depression) has been repaired: "3. In 2016 the berm wall around the reservoir had a depression near the northeast corner, this issue has been resolved."

Resolution

The area of erosion did not result in any "structural" damage to the reservoir; the geomembrane liner was not breeched. The "depression" was more of an aesthetics issue, the bigger concern would have been the inability of the diversion ditch to prevent the erosion from happening in the first place. Kudlik Construction addressed that issue.

In the "Draft List of Commitments Resulting from Technical Meeting for Water Licence No. 3AM-PAN---Renewal Application", Item No. 5 requested "...pictures, engineering drawings and/or plans associated with the reservoir berm rehabilitation work that took place in 2017" (the work was actually in 2016). As the damage was minor in nature, there were no engineering drawings and/or plans developed. The problem was addressed by re-grading

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the diversion ditch to promote the re-directing of any runoff away from the reservoir, and replacing and re-grading the eroded material on the berm. The reports and pictures provided with this memo indicate such and that the issue has been resolved.

Submitted by:

Stephen G. Bliss, M.Sc.E., P.Eng.
Senior Project Engineer

EXP Services Inc.

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

WATER LICENCE INSPECTION FORM

☒ Original
☐ Follow-Up Report

Licensee	Licensee Representative
Hamlet of Pangnirtung	John Hussy
Licence No. / Expiry	**Representative's Title**
3BM-PAN1417	Senior Administrative Officer
Land / Other Authorizations	**Land / Other Authorizations**
Date of Inspection	**Inspector**
July 27, 2016	Justin Hack

Activities Inspected

☐ Camp ☐ Drilling ☐ Mining ☐ Construction ☐ Reclamation ☒ Fuel Storage
☐ Roads/Hauling ☐ Other: Water Discharge ☒ Other: Municipal

Conditions: **A - Acceptable** **C - Concern** **U - Unacceptable** **NA – Not Applicable** **NI – Not Inspected**

Water Use	Condition	Comment	Site Conditions	Condition	Comment	Haz/Mat Management	Condition	Comment
Intake/Screen	NA		Water Management Structures	C	3, 8-11	Storage	A	
Flow Measure. Device	A		Culverts / Bridges	A		Spills	A	
Source:	A		Drainage	NA		Spill Plan	A	
Water Use:	A		Erosion / Sediment	A				
Recirculation (y /n)	NA		Mitigation Measures	A		**Administrative**		
			Reclamation Activities	NA		Records		
			Materials Storage	NA		Reports	NI	
Waste Disposal			Signage	A		Plans	NI	
Waste Water	A					Notifications	NI	
Solid Waste	A		**Monitoring**			**Other**		
Hazardous Waste	A		Sample Collection / Analysis	NI		Inspection report compliance	A	
						Compliance with issued Direction	A	

**The number in the comments field will correspond with specific comments provided below.*

Samples taken by Inspector:	Location(s):
☐ Yes ☒ No	

SECTION 1 ☒ **Comments** (s.1-2) ☐ **Non-Compliance with Act or Licence** (s.3) ☐ **Action Required** (s.4)

Inspectors Statement

On July 27 2016, a water licence inspection was conducted at the Hamlet of Pangnirtung, Qikiqtani Region, Nunavut. Sites inspected included the Waste Water Treatment Plant, the Solid Waste Disposal Facility, the Metal Storage Facility Berms, and the Water Distribution Facility.

Background

The Hamlet of Pangnirtung has an active licence for the use of 299 cubic meters of water per day and is permitted to dispose of waste under conditions in which the waste may enter water at the Waste Water Treatment Plant, Solid Waste Disposal Facilities and Metal Disposal Facility.

Inspection

Water Use and related structures:

1. Water is being withdrawn from the Duval River as approved in the Water License by a diesel pump located near the riverbed.
2. In 2015, the Hamlet of Pangnirtung withdrew approximately a total of 51,217m^3 of water and is withdrawing water at approximately the same rate in 2016.
3. The berm wall around the reservoir has a depression near the northeast corner. This was likely caused from upstream surface water run-off. The depression is likely allowing surface water from the surrounding environment to flow into the reservoir during heavy rainfall events only. This should be addressed to maintain the designed integrity of the structure. See *Figure A*.

Waste Water Treatment Plant

4. No concerns with the operation of this facility related to the discharge of waste to freshwater.
5. Records were kept up to date.

6. Treated Effluent is discharged approximately 30 feet from the shoreline and the main receiving environment is the ocean. The effluent does not enter any water on its path to the ocean.

Solid Waste Facility:

7. As outlined on Page ix of the Licence, the Nunavut Water Board understands that a small amount of leachate can leave the site and enter the surrounding environment. The receiving environment of the landfill is the ocean. Under INAC, discharges of wastes to the ocean are regulated by the Arctic Waters Pollution Prevention Act. If this leachate is considered a waste entering Arctic Waters, the proponent must be aware that this is to be authorized by INAC. Ditches around the domestic landfill remain in good order and are sufficiently channeling water around this facility at the time of inspection.

Metal Storage Area:

8. The community is segregating and storing metals, vehicles, batteries, and electronic waste within the Metal Storage Area. Small amounts of leachate appear to be entering a small amount of surface water at this facility before it drains into the ocean.
9. Due to changing drainage patterns coming off of the mountains behind the metal disposal area, the berm walls surrounding this facility has been breached in previous years which led to water flowing through the facility in three separate locations.
10. The Hamlet has since addressed this issue by filling the breached sections of the berm with hardened cement and soil to divert the surface water around the metal storage area. However, water is accumulating behind these sections and the water is slowing exfiltrating into the Metal Storage Area. See *Figure B*.
11. INAC has concern related to this structure because of its inability to properly divert water around the metal storage area causing small amounts of leachate to enter the surface water.
12. The space required for the metal storage remains an issue for Pangnirtung. Practical short-term solutions do not appear feasible and the community is trying to determine a plan to deal with this issue.

PHOTO LOG

Date	Camera	Inspector	Authorization
27/07/2016	SONY DSC-HX50V	Justin Hack	3BM-PAN1417

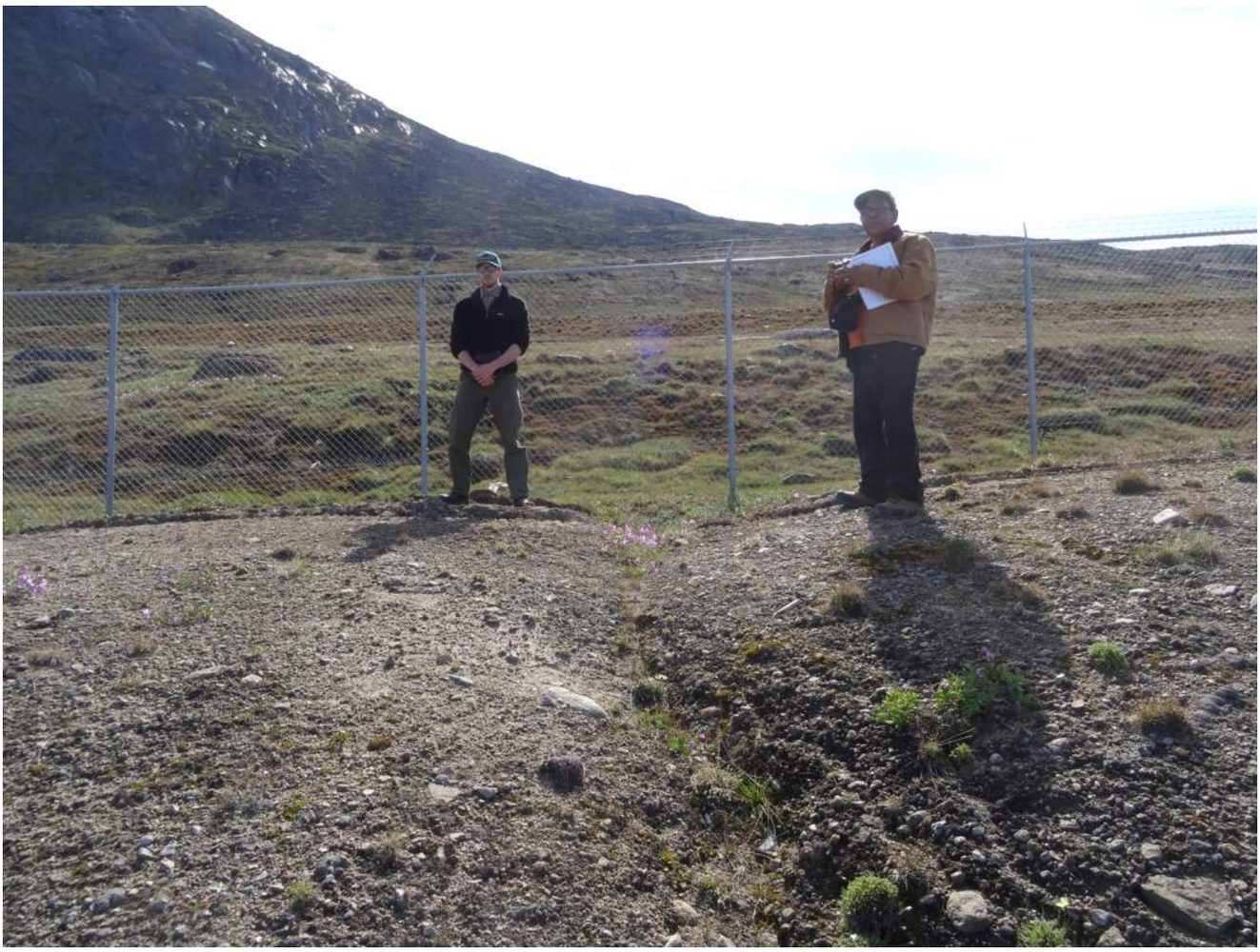

Figure A: Photo of the erosion caused by surface water near the northeast corner of the water reservoir.

Figure B: One of three locations where water has built up behind the berms surrounding the metal storage area.

Licensee or Representative	Inspector's Name
	Justin Hack
Signature	**Signature**
	
Date	**Date**
	September 8, 2016

Office Use Only: Follow-up report to be issued by Inspector	☐ Yes ☐ No

FINAL SITE REVIEW REPORT

Project Name:	Pangnirtung Improvements to Water Supply System (Truck Fill Station)
Client No.:	GNCGS-08-2009
Client:	Government of Nunavut – Community and Government Services (GN-CGS)
Consultant:	ARKTIS Solutions Inc.
Contractor:	Kudlik Construction Ltd. (Kudlik)
Page Total:	15
Dates:	September 07, 2016

Periodic site review is for the sole purpose of ascertaining conformance with the general design concept, and will not augment or replace the Contractor's quality control nor relieve the Contractor of contractual responsibilities. Site review does not relieve the Contractor's responsibility for errors or omissions or requirements of the Construction and Contract Documents including all applicable codes.

Present:	Kudlik Construction	**Time:**	09:30 am
	ARKTIS Solutions Inc.	**Condition:**	Partly cloudy, breezy
	GN-CGS	**Temp.:**	4°C
		Location:	Pangnirtung, Nunavut

Distribution:

GN-CGS – Grigor Hope; ghope@gov.nu.ca
Kudlik Construction – Dominique Marceau; dmarceau@kudlik.biz
Kudlik Construction – Louis Breton; construction.lb@hotmail.com

Site review summary:

A site review was performed by ARKTIS Solutions Inc. (ARKTIS) on September 07, 2016 to serve as the final inspection. The inspection was performed by:

- Civil inspection: Jason Thorpe, P.Eng. of ARKTIS;
- Structural inspection: Tim Krahn, P.Eng. of Building Alternatives Inc. (retained by ARKTIS);
- Mechanical inspection: Michel Malliet, P.Eng. of Chiarelli Engineering Management Ltd. (retained by ARKTIS); and
- Electrical inspection: Nick Korbel, P.Eng. of Chiarelli Engineering Management Ltd. (retained by ARKTIS).

This site review is intended to serve as the final site review inspection to observe the civil, structural, mechanical and electrical components for the construction of the truck fill station building. Review comments are broken down by each of the engineering disciplines (civil, structural, mechanical and electrical).

Civil Inspection:

1. The nine culverts noted on Drawing C100 were observed as constructed.

2. The overflow ditch (Drawing C100) was not observed to be constructed. ARKTIS brought this to the attention of Kudlik during the inspection as a deficiency; Kudlik promptly rectified this deficiency and constructed the overflow ditch on September 07, 2016 by means of mechanical excavator and was witnessed by ARKTIS.
3. The primary diversion ditch (Drawing C100) was observed to be actively receiving seepage/runoff water and diverting it towards the west, as noted on the drawings.
4. The secondary diversion ditch (Drawing C100) was observed to have been cleaned out by means of mechanical excavator. The secondary drainage ditch was noted to be sloped to promote water drainage around the reservoir, both towards the east and west. A low spot located approximately towards the centre of the reservoir was noted during the inspection, which may cause runoff waters from entering the reservoir area. ARKTIS notified Kudlik of this deficiency. Kudlik noted that they will deepen the secondary cutoff ditch in that area to promote drainage around the reservoir.
5. The water reservoir was being actively filled with water from the Duval River during the inspection. Rip-rap was not placed along the interior slopes of the reservoir as directed previously by ARKTIS in 2015. The area along the western slope of the water reservoir in the vicinity of the filler pipeline/overflow pipe that experienced erosion was observed to have been repaired with rip-rap.
6. The areas of erosion (Drawing C100) along the exterior slope of the reservoir's northern berm were observed to have been regraded/repaired.
7. The drainage ditch/swale along the new truck turn (Drawing C200) around was being used during the site inspection for truck fill building pump and treatment tests.
8. The fill material under and above the new intake pipes (Drawing C200) appears to be in excellent condition.
9. The earthworks/grading in the vicinity of the exterior stairs (Drawing C200) to the new building was not completed. Kudlik noted during the inspection that the existing truck fill station was being actively used by the Hamlet, and further grading (adding fill) adjacent to the stairs would prevent filling of water trucks at the old truck fill station. The grading/fill activities should be completed in coordination with the change of operation from the old to the new truck fill stations.

Southern interior slope looking towards east

Southern interior slope looking towards west

Northern interior slope looking towards east

Western interior slope adjacent to filler pipe repaired with rip-rap

View of intake pipe looking towards southeast

View of granular cover over intake pipes looking towards west into the reservoir

View of secondary diversion ditch, showing area that will need to be regraded by Kudlik. Kudlik to submit photograph once completed. View looking towards east.

Secondary diversion ditch looking from new truck fill station towards the southeast

View of primary diversion ditch looking towards west showing flow of water towards the west.

View of overflow ditch being excavated by Kudlik during site inspection. View looking towards northwest.

View of secondary diversion ditch along new truck turn around showing flow from pump testing. View looking towards southwest.

View of reservoir's northern berm exterior where erosion has been regraded/repaired. View looking towards southeast.

View of area adjacent to new truck fill station stairs that are being encroached on by trucks using old truck fill station. Fill to extend approximately 1 m from the stairs towards the rear of the truck in the photograph.

Structural Inspection:

See attached structural inspection report.

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WATER LICENCE INSPECTION FORM

☒ Original
☐ Follow-Up Report

Licensee	Licensee Representative
Hamlet of Pangnirtung	Bhabesh
Licence No. / Expiry	**Representative's Title**
3BM-PAN1417	Senior Administrative Officer
Land / Other Authorizations	**Land / Other Authorizations**
Date of Inspection	**Inspector**
October 2, 2017	Jonathan Mesher

Activities Inspected

☐ Camp ☐ Drilling ☐ Mining ☐ Construction ☐ Reclamation ☒ Fuel Storage
☐ Roads/Hauling ☐ Other: Water Discharge ☒ Other: Municipal

Conditions: **A - Acceptable** **C - Concern** **U - Unacceptable** **NA – Not Applicable** **NI – Not Inspected**

Water Use	Condition	Comment	Site Conditions	Condition	Comment	Haz/Mat Management	Condition	Comment
Intake/Screen	NA		Water Management Structures	C		Storage	A	
Flow Measure. Device	A		Culverts / Bridges	A		Spills	A	
Source:	A		Drainage	NA		Spill Plan	A	
Water Use:	A		Erosion / Sediment	A				
Recirculation (y /n)	NA		Mitigation Measures	A		**Administrative**		
			Reclamation Activities	NA		Records		
			Materials Storage	C		Reports	NI	
Waste Disposal			Signage	A		Plans	NI	
Waste Water	A					Notifications	NI	
Solid Waste	A		**Monitoring**			**Other**		
Hazardous Waste	A		Sample Collection / Analysis	NI		Inspection report compliance	A	
						Compliance with issued Direction	A	

**The number in the comments field will correspond with specific comments provided below.*

Samples taken by Inspector:	Location(s):
☐ Yes ☒ No	

SECTION 1 ☒ **Comments** (s.1-2) ☐ **Non-Compliance with Act or Licence** (s.3) ☐ **Action Required** (s.4)

Inspectors Statement

On October 2, 2017, a water licence inspection was conducted at the Hamlet of Pangnirtung, Qikiqtani Region, Nunavut. Sites inspected included the Waste Water Treatment Plant, the Solid Waste Disposal Facility, the Metal Storage Facility Berms, and the Water Distribution Facility.

Background

The Hamlet of Pangnirtung has an expired licence for the use of 299 cubic meters of water per day and is permitted to dispose of waste under conditions in which the waste may enter water at the Waste Water Treatment Plant, Solid Waste Disposal Facilities and Metal Disposal Facility.

Inspection

Water Use and related structures:

1. Water is being withdrawn from the Duval River as approved in the expired Water Licence.
2. In 2016, the Hamlet of Pangnirtung withdrew approximately a total 47,372.54 m3 of water and is withdrawing water at approximately the same rate in 2017.
3. In 2016 the berm wall around the reservoir had a depression near the northeast corner, this issues has been resolved.
4. The Inspector is requesting that the licensee accounts for its water usage at the point where it is withdrawn from Duval River and pumped into the reservoir for storage. This will provide the Nunavut Water Board and the Inspector with An accurate reading of water usage.

Waste Water Treatment Plant

5. Treated effluent is discharged approximately 30 feet from the shoreline and the main receiving environment is the ocean. The effluent does not appear to affect inland waters.
6. Records were kept up to date and made available to the inspector.

Solid Waste Disposal Facility (SWDF):

7. As outlined on Page ix of the Licence, the Nunavut Water Board understands that a small amount of leachate can leave the site and enter the surrounding environment. The receiving environment of the landfill is the ocean. Under INAC, discharges of wastes to the ocean are regulated by the Arctic Waters Pollution Prevention Act.
8. In figure 1 you can see ice where the flow leaves the facility. This Location is listed in the licensee's Monitoring Program Stations as PAN-5 and is required to be tested 3 times per year.
9. Swales around the domestic landfill appear to be good condition and appear to be effectively diverting water around the facility at the time of inspection.

Metal Storage Area:

10. The community is segregating and storing metals, vehicles, batteries, and electronic waste within the Metal Storage Area.
11. This location has issues with changing drainage patterns coming off of the mountains behind the metal disposal area, the non-engineered berm walls surrounding this facility had been breached in the past which led to water flowing through the facility in three separate locations.
12. The Hamlet has attempted to fix the breached sections of the berm with hardened cement and soil. However, water is accumulating behind low-lying sections and is slowing infiltrating the Metal Storage Area. See *Figure 2*.
13. INAC has expressed concern related to this structure in past reports because of its inability to properly divert water around the metal storage area.
14. The space required for the metal storage remains an issue for Pangnirtung, Practical short-term solutions do not appear feasible. The community along with the Government of Nunavut is currently working towards a new waste management facility.

PHOTO LOG

Date	Camera	Inspector	Authorization
03/10/2017	SONY DSC-HX50V	Jonathan Mesher	3BM-PAN1417

Figure 1: PAN-5 monitoring location.

Figure 2: Water infiltration of the metal storage area.

Licensee or Representative	Inspector's Name
	Jonathan Mesher
Signature	**Signature**
	Signature on original document
Date	**Date**
	October 2, 2017

Office Use Only: Follow-up report to be issued by Inspector	☐ Yes ☐ No